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Optical cable element

Abstract:

An optical cable element having a core and one or more optical fibers. The optical fibers may be provided with a separate secondary coating. The optical fiber or the secondary coating is connected to the core by a permanently elastic adhesive.

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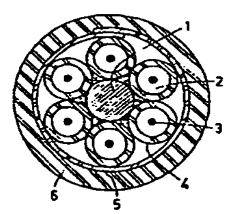
(54) **Optical cable element.**

(57) An optical cable element having a core and one or more optical fibres which may comprise a separate secondary coating, the optical fibre or the secondary coating being connected to the core by means of a permanently elastic adhesive.



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"Optical cable element".

The invention relates to an optical cable element having a core and at least one optical fibre which is provided around the core and which may comprise a separate secondary coating of a synthetic resin.

Such an optical cable element is known _inter alia_ from the periodical Philips Telecommunications Review, Volume 37, No. 4, September, 1979, _pp_. 231-241 and _pp_. 251-256. The optical cable element known from these references comprises a central core manufactured from an aromatic polyamide synthetic resin of high density, for example, the polyamide synthetic resin known by the tradename of Kevlar. 6 optical fibres are twisted around the core that is provided in spiral form on the surface of the core. Each optical fibre has a separate secondary coating provided by an extrusion process, for example, a secondary coating manufactured from polyvinylidene-difluoride within which the fibre can move freely. A polythene foil is wound around the cable element and is covered with an extruded synthetic resin sheath of, for example, polythene which may be reinforced with glass fibres. It is stated on page 255 of the above literature reference that the pulling forces exerted on the cable element, for example, upon installation thereof, act on the outside of the element and have to be taken up and compensated for by the core. The secondary coating may not be used to transmit the pulling forces to the central core so that the cable element must be provided with an external strain relieving element.

It is an object of the invention to provide a cable element of the above-mentioned type which can withstand pulling forces exerted on the outside of the element without thus requiring an external strain relieving member.

Another object of the invention relates to a

cable element which notably can withstand bending forces.

According to still another object, a cable element is provided which can be produced at a high manufacturing speed.

A further object of the invention is to provide a cable element having an improved longitudinal watertightness.

These objects are achieved with a cable element of the type mentioned in the opening paragraph which is characterized in that the optical fibre, or, in the presence of a separate secondary coating, said coating, is connected to the core by means of a permanently elastic adhesive.

In one embodiment of the cable element according to the invention several optical fibres are used, for example, six fibres. Optical fibres each having a separate secondary coating are to be preferred. It is to be noted that the optical fibre always comprises a so-called primary coating of synthetic resin which is provided on the surface of the fibre and protects it from damage.

By means of the measure according to the invention, as a result of the greatly increased friction between core and optical fibres, or in the case in which optical fibres are used having a separatesecondary coating, with strongly increased friction between core and secondary coatings, it is achieved that a pulling force acting on the outside of the element is transferred optimally <u>via</u> fibres or secondary coatings to the core without the fibres and/or secondary coatings being damaged.

A strong construction is obtained with a clear bond between the fibres or secondary coatings and the core. As a result of this bond the linear expansion of notably the secondary coating in the case of temperature variations will be influenced by the core. With a suitable choice of the core materia', for example, a core of steel, the expansion of the secondary coating will be inhibited by the core and thus be in better agreement with the small thermal expansion of the optical fibre. This implies that the cable

element according to the invention may be used over a wider temperature range, in particular when fibres are used having a separate secondary coating. In spite of the rigid construction, relative movement of fibres or secondary coatings with respect to the core is possible due to the elasticity of the adhesive and this occurs mainly in the radial or tangential direction, that is to say a direction at right angles to the longitudinal axis of the core. As a result of this the differences in length occurring upon bending the element can be compensated for.

The use of a permanently elastic adhesive according to the invention has the further advantage that upon coupling the cable element t another cable element or to a termination, the various optical fibres do not spread fan-wise so that possible damage is avoided. The fibres or secondary coatings can easily be detached from the layer or adhesive.

Permanently elastic adhesives are well known and are commercially available.

A very suitable adhesive for use in the element according to the invention is a hot melt adhesive, that is to say an adhesive which is provided in the molten state while warm, and solidifies and adheres upon cooling. Examples of useful hot melt adhesives are the known adhesives on the basis of the copolymer poly(ethene-vinyl acetate).

A preferably used hot melt adhesive is a pressure sensitive adhesive on the basis of the above-mentioned copolymer.

The core used in the element may be manufactured from metal. It is also possible to use a core of a synthetic resin, for example, a polyamide core or a core of a reinforced synthetic resin, for example, an epoxy or polyester core reinforced with glass fibres or polyamide fibres.

In a favourable embodiment of the cable element according to the invention the adhesive is distributed over the whole surface of the core or over circumferential parts

of the surface of the core which are situated at mutually equal distances viewed in the longitudinal direction of the core. In such embodiment the adhesive obstructs the creepage paths of moisture in the longitudinal direction of the element so that an improved longitudinal water-tightness is obtained. The cable element according to this embodiment can also be manufactured more easily in the case in which the optical fibres or the secondary coatings comprise a layer of adhesive. This applies in particular to a further preferred embodiment in which the thickness of the layer of adhesive provided on the core is smaller than the diameter of the optical fibre or, in the presence of a secondary coating, is smaller than the diameter of the coated fibre. In the last-mentioned embodiment the layer of adhesive does not extend to beyond the outside (circumferential edge) of fibres or secondary coatings. Herewith a sticking effect of the cable element is avoided which occurs in the case of larger thicknesses of the layer of adhesive and which constitutes a serious technical problem in the further processing of the cable element, for example, the twisting of more elements to form one optical cable, and the storage of cable elements on reels.

In still another favourable embodiment, the optical fibre or the secondary coating is embedded in SZ configuration in the layer of adhesive present on the core.

An SZ configuration is a known favourable form for an optical fibre which presents optical and technological advantages as compared with a spiral form. An SZ form can perhaps best be described as a sine wave bent around the core. An SZ configuration is obtained by rotating a feeding device of optical fibres with which the optical fibres are continously guided over the surface of the core and in the longitudinal direction thereof, periodically and alternately to the left and to the right over an angle of rotation of, for example, 360°. Instead of rotating the feeding device it is also possible to rotate the core periodically to the left and to the right. In the element accor-

ding to the invention the optical fibre or secondary coating is provided in SZ form on the surface of the core by means of the permanently elastic adhesive. Due to the layer of adhesive a direct fixation in SZ form is possible. Up till now an SZ form has been realized by providing grooves having an SZ configuration in the surface of the core and then laying optical fibres not having secondary coatings in the grooves.

In yet another favourable embodiment a folded foil is provided around the core and the attached optical fibre and is covered with a sheath of a synthetic resin.

As a result of the good fixation of the fibre or secondary coating on the core by means of the permanently elastic adhesive, a wound foil need not be used in the element according to the invention as is described in the above-mentioned literature reference. The use of a folded foil has the practical advantage of a considerably increased speed of manufacture. In this connection it is to be noted that winding a foil is a laborious and speed-restricting process step. Folding a foil, that is to say a longitudinal bending of a foil, does not have this disadvantage. The foil is preferably a foil of a synthetic resin, for example, a polyester foil or polyethene foil which, if desired, may be metallised. The foil serves as a heat shield to protect the optical fibres upon providing the sheath.

The element according to the invention can be manufactured in a simple manner in a continuous process step by providing the core over the whole length, or periodically over a part of the length, with a layer of adhesive, providing the optical fibres which may each have a separate secondary coating in the desired configuration on the surface of the core, then, if desired, folding a foil around the core with attached fibres or secondary coatings and extruding a synthetic resin sheath over the foil.

The invention will now be described in greater detail with reference to the drawing, the sole Figure of which is a cross-sectional view of an optical cable element

according to the invention.

In the Figure, reference numeral 1 denotes a core which is formed by a steel litz wire. Over the whole circumference of the core 1 a layer 2 of a hot melt adhesive is provided. Six optical fibres 3 in SZ form are present around the core 1 with layer of adhesive 2. The fibres have a thickness of 100 /um and comprise a primary coating of approximately 4 /um, not shown. Each fibre is surrounded by a separate secondary coating 4 of synthetic resin which is permanently elastically connected to the core 1 by means of a layer of adhesive 2. The secondary coating of synthetic resin has a thickness of approximately 0.6 mm. and is manufactured from polyvinylidene difluoride. A foil 5 of synthetic resin folded with overlap is provided around fibres 3 with secondary coatings 4 and in turn is surrounded by an extruded sheath 6 of synthetic resin which is manufactured from polyethylene.

CLAIMS

1. An optical cable element having a core and at least one optical fibre which is provided around the core and which may comprise a separate secondary coating of synthetic resin, characterized in that the optical fibre, or, in the presence of a separate secondary coating, said coating, is connected to the core by means of a permanently elastic adhesive.

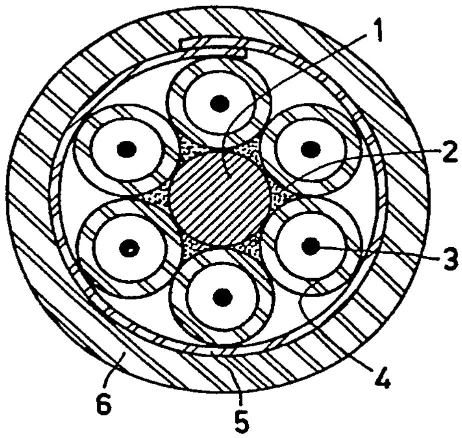
2. An optical cable element as claimed in Claim 1, characterized in that a hot melt adhesive is used.

3. An optical cable element as claimed in Claim 1 or 2, characterized in that the adhesive is distributed over the whole surface of the core or over circumferential parts of the surface of the core which are present at mutually equal distances viewed in the longitudinal direction of the core.

4. An optical cable element as claimed in Claim 3, characterized in that the thickness of the layer of adhesive is smaller than the diameter of the optical fibre, or, in the presence of a separate secondary coating, is smaller than the diameter of the coated fibre.

5. An optical cable element as claimed in Claim 4, characterized in the optical fibre of the secondary coating are embedded in the layer of adhesive in SZ configuration.

6. An optical cable element as claimed in Claim 1, characterized in that a folded foil is provided around the core and the optical fibre or secondary coating connected thereto and is coated with a sheath of a synthetic resin.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